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E-journals: the OhioLINK experience

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Abstract

This paper discusses the OhioLINK Electronic Journals Center which was first made available to users in April 1998. The paper includes usage data on the 2 years of operation as well as the design and philosophy behind the project. In addition, the paper explores research on what users want, how best to anchor the existence of full-text resources in the minds of researchers as well as common maintenance problems for electronic journals in the library online catalog.

1. Background

1.1. What is OhioLINK?

Much has been written about the history, founding and goals of OhioLINK [1]. Additional information can be found under the About OhioLINK section of the consortium's home page which provides the most accurate and up to date summary of its composition and structure http://www.ohiolink.edu/about/what-is-ol.html. "The Ohio Library and Information Network, OhioLINK, is a consortium of Ohio's college and university libraries and the State Library of Ohio. Serving more than 500,000 students, faculty, and staff at 79 institutions, OhioLINK's membership includes 17 public universities, 23 community/technical colleges, 38 private colleges and the State Library of Ohio. OhioLINK serves faculty, students, staff and other researchers at member institutions via 113 campus-based library systems and networks, and the Internet.

OhioLINK offers access to more than 31 million library items statewide. To date, the OhioLINK central catalog contains more than 7 million unique master records from its 79 institutions, encompassing a spectrum of library material including law, medical and special collections. The catalog systems throughout the state provide capacity for more than 4,500 simultaneous users. The OhioLINK central catalog also is available to outside users through the Internet. OhioLINK offers user-initiated, non-mediated online borrowing through its statewide central catalog. Our students and faculty have the ability to electronically request items while searching the OhioLINK central catalog. It also provides a delivery service among member institutions to speed the exchange of library items.

In addition to the central catalog, users can access electronic research databases including a variety of full-text resources. However, access to the research databases is restricted to OhioLINK member users (valid patrons at OhioLINK member institutions).

Ninety-eight research databases covering a variety of disciplines are at the users' finger-tips. Many of the databases are citation indexes. They cover many academic areas at varying levels of detail. In many cases, the user can find out which OhioLINK members possess copies of the

cited journal. OhioLINK's electronic full-text resources include online encyclopedias, dictionaries, literature, and journal articles. . . .

The newest service area is the multi-faceted Digital Media Center. It is designed to archive and provide access to a variety of multi-media material. We currently house a large collection of North American museum images and other art and architecture images and a growing variety of digitized images from library collections. Soon to be available are the Landsat7 satellite images of Ohio. Audio and video possibilities are being investigated [2].

What this means on a daily basis is that the library patron has access to their library's local online catalog as well as the OhioLINK central catalog – an impressive total of 31 million plus individual items. Without staff assistance, the patron can request shipment of virtually any item found to his local library for pickup. Thus, a key element of the OhioLINK service is the delivery of material between any participating libraries within 3–5 days. For example, at the University of Cincinnati (one of the largest libraries in OhioLINK), 15% of their total circulation transactions now involve other OhioLINK libraries in either lending or borrowing material. That compares to a U.S. national average for interlibrary loans of less than 0.5 percent. In concrete terms, UC does more than 4,000 lending and borrowing transactions for physical pieces within OhioLINK every week. The OhioLINK delivery contract allows for the delivery of material for an average cost of 40 cents per item —a bargain in anyone's calculations. In addition, the internal library cost for processing this material is approximately $1 per piece while the national average for traditional interlibrary loans is $30 (which is why most libraries only process 0.5% of their transactions this way) [3].

1.2. What is the Electronic Journals Center?

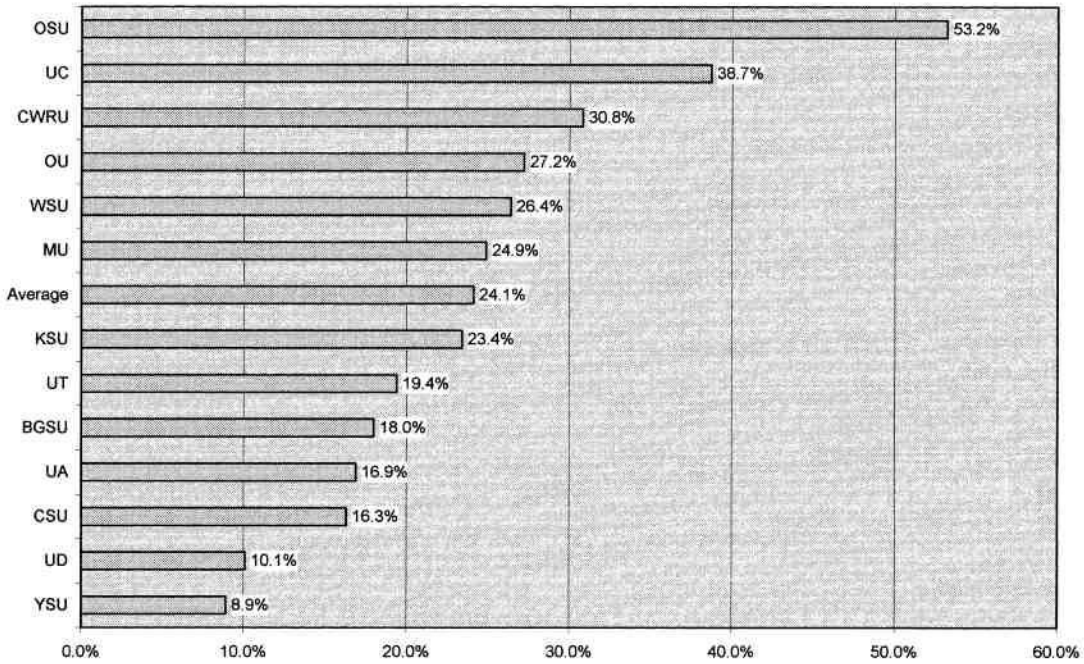
Building on this efficiency for the delivery of books, OhioLINK needed to find a solution for the delivery of articles from journals. For years, libraries had watched their buying power erode particularly related to the expenditure of money for serial subscriptions. In November 1995, the OhioLINK Document Delivery Strategy Task Force distributed a white paper which outlined the problems associated with current practices for journal subscriptions, both access and usage in a consortium such as OhioLINK. The document identified 3 basic problems: rapidly increasing costs for journal subscriptions; the availability of 30+ citation databases through OhioLINK was generating greater demand for actual textual material (requests for journal articles via OCLC's ILL system were running 15-20% over the previous year); and expanding the OhioLINK model of supplying the journal literature from the collections around the state would result in significant questions about our adherence to copyright and fair use guidelines. These problems created a short and long-term environment that was not compatible with OhioLINK's mission and philosophy to maximize access to information at affordable costs. The key solution proposed was to obtain licenses for journal use on a statewide basis at the publisher level maximizing the power and size of OhioLINK. "Using the leverage of our combined purchasing power, we were able to strike a deal to provide every OhioLINK library with full electronic access to all of [Elsevier and Academic Press'] titles, more than 1,300, and continue to receive print versions of all titles to which we were already subscribing. With a minor subsidy from OhioLINK, [the libraries receive] all this for no more than [they were] paying for half the number of print journals" [4]. OhioLINK believed that a greater volume of journal literature could be consumed by our users under a different model. This higher use, lower cost model could be a win-win for both OhioLINK and the publishers. The key points of the concept included:

- We would subscribe to the intellectual content not the physical method of delivery.
- Subscribing would be a group activity not title by title or library by library. Within the consortium, users would have unlimited access to individual articles whether in electronic or print form. Use outside the group would still be subject to traditional regulations and guidelines.
- The initial license would be equal or greater in price than that amount currently paid collectively for the print material. However, subsequent increases would be more closely tied to the inflation rate [5].

Another way of stating the strategy: first, the OhioLINK libraries were going to spend the dollars anyway and continue to lose title access. In other words, cost increases would mean that the same amount of money would continue to be spend but the libraries would also have to cancel titles. As a result, the same dollars would buy access to fewer titles. Second, rather than getting less access for those dollars as individual libraries, the libraries could get more by acting collectively. Third, the assumption was made that if these titles were easily accessible to the researcher, they would use them more. As the usage data shows, they do [6].

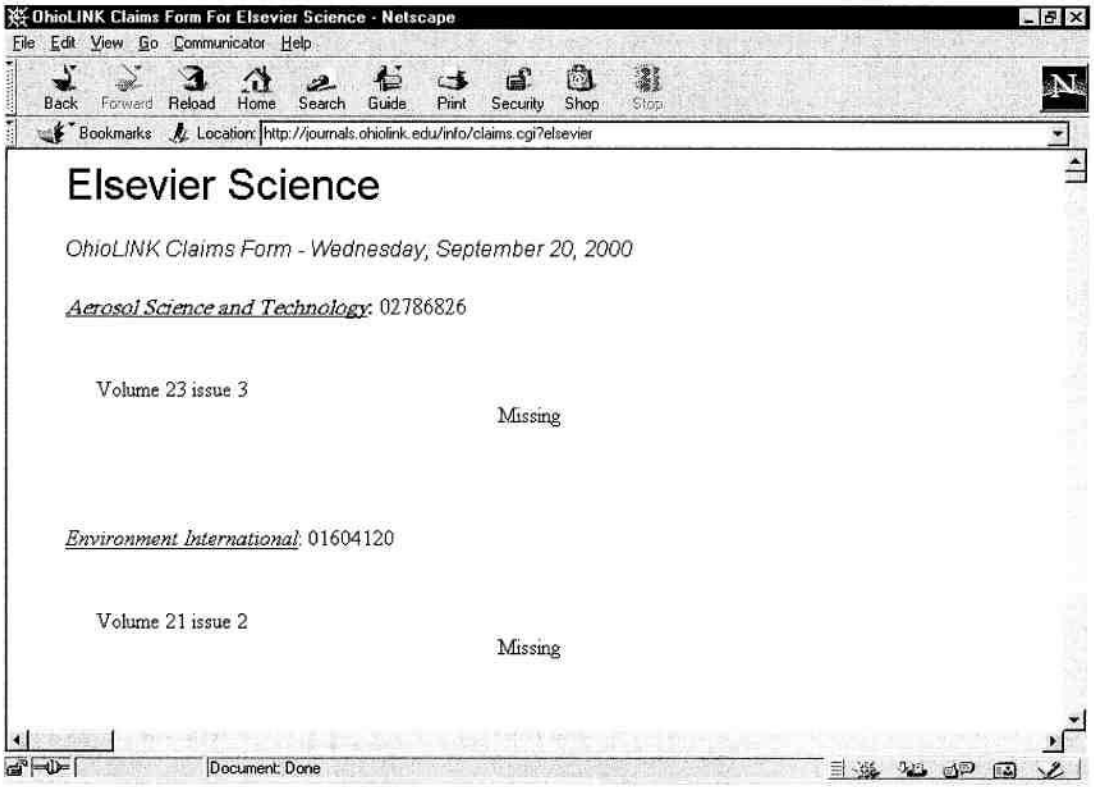
The first contract signed for the EJC was in 1996 with Academic Press for 175 titles. When the first three year contract with Elsevier was signed in 1997, "the major universities in OhioLINK average[d] only 260 of the [1,150] Elsevier titles per institution. Two-year colleges, collectively, [had] only 13 of the journal titles" [7]. At the same time, the OhioLINK libraries had identified 18 important publishers including large and small commercial publishers and various society publishers. The 4,106 titles publishers by these 18 publishers would provide the core collection of most interest to OhioLINK libraries. The attached chart shows the percentage of titles owned by each of the universities in OhioLINK. "Ten of the thirteen libraries hold fewer than 30% of the titles. Only Ohio State University holds more than half of the titles in print, with only 53.2% ownership. At the low end of the range, Youngstown State University holds only 8.9%" [8].

Chart 1. % of Titles Held at Each OhioLINK University



The number drops off quickly as the size of the university and its budget decreases [9].

As the negotiation with initial publishers (Academic and Elsevier) continued, OhioLINK articulated 4 objectives: stability in pricing, much greater information access and utility, multi-year agreements to further stabilize and plan budgets, and extremely reasonable access fees to organizations currently receiving no Elsevier journals (in particular the small colleges and 2 year institutions). For subscription year 1996, 4,088 print subscriptions to Elsevier titles were held by 20 of the 76 OhioLINK institutions at a cost of $5,291,432. The total number of titles purchased by 1 or more institutions was 853 (of a total of 1,150 available titles). This decision on OhioLINK's part to enter into a multi-year deal for all of the content has been the source of some controversy and criticism within the library profession but the information available now about usage since implementation (discussed later in the paper) supports the decisions made. In addition, OhioLINK was able to successfully negotiate a more reasonable annual inflation rate for these titles than was ever possible prior to the consortial contract. Finally, when the current contract with some of the early publishers is due for renegotiation in 2002/2003, OhioLINK expects to consider negotiating to eliminate some content based on the usage data that is available. This approach would allow OhioLINK to reset the financial base at a lower point and concentrate on the most used material. This is the most effective way to spend the available funds wisely and make better informed selection decisions. What isn't known is whether there will be any negative reaction from users if titles which they access at low levels are no longer available.



1.3. EJC specifics

From the conception of the EJC, the intention was to load the journals on a local machines.

In mounting these journals locally, links to citation databases, the OhioLINK central catalog, and to local catalogs could be provided. An electronic version of each journal is stored on OhioLINK servers and is accessible using the Orion Scientific Systems software search interface. As of September 2000, the EJC had 3,230 journal titles from Academic Press, American Chemical Society, American Institute of Physics, American Physical Society, Elsevier, Johns Hopkins University Press (Project Muse), Institute of Physics, Kluwer, MCB University Press, Royal Society of Chemistry, Springer-Verlag, and Wiley. Containing more than 1.9 million articles, "the EJC is one of the largest locally stored electronic journal collections in the country. No single library could afford to purchase all these journals in print, but by working together, the OhioLINK community now delivers an invaluable research tool to Ohio higher education" [10]. New articles are added from each publisher weekly. Distribution of articles depends on the publisher. The electronic version may precede, coincide with, or even follow publication of the print version. The EJC software detects missing issues which are reported to the publisher. A report is available online for libraries to review the content which has been detected as missing and claimed from the publisher.

However, sometimes an article citation will appear in the EJC but the PDF file for the text is either blank, unreadable or incomplete. These cannot be detected by the software and must be reported by users when found. As newer versions of the ScienceServer software are installed; significant enhancements occur. In July 1999, the new software allowed OhioLINK to load new journal issues in 7 h, down from 32 h in previous versions of the software. More recently, the EJC was enhanced by OhioLINK programmers to improve the script for reporting usage statistics. This is an interactive form that allows individual libraries to gather usage statistics on their own. This usage data are secured in the staff area of the software which is accessible only by password. However, this password is freely available to staff in OhioLINK libraries allowing virtually any staff member to review and access the data. The report is generated in real time and can focus on a particular institution, a particular journal or a particular publisher. The date range can be for as little as a single day up to the entire period of time that the EJC has been available. In essence, the library can select from various options for the time period covered; whether to include only a certain publisher, and whether to limit the report to one OhioLINK member institution or all institutions.

OhioLINK is not a participant in Elsevier's ScienceDirect aggregator service. Instead, OhioLINK negotiates independently with each publisher and then loads the data to local servers which serve only OhioLINK libraries. "One of the underlying premises of Science-Direct is that it is more efficient to have a large corpus of information in one location than to have to go to hundreds or thousands of individual Web sites for each title or small cluster of titles. . . . Again the goal is to provide as comprehensive an environment as possible and to permit users to move from one environment or server to another with a minimum of disruption" [11]. In theory and practice, the EJC shares the underlying premise of Science-Direct. It includes data from many publishers and presents a single interface to the user. The primary difference is that OhioLINK controls the content of the servers and loads the data locally. In addition, OhioLINK negotiates and decides which publisher content is desired and is added. OhioLINK's approach is to acquire the e-versions for all of the titles published by a given publisher. Once adequate usage data are available, the desirability of these comprehensive contracts can be reviewed and a determination made about whether we to negotiate only for specific titles.

Archiving is a core issue for projects of this nature as well. OhioLINK's solution to this problem from the beginning was to acquire perpetual archival rights in its licenses and ensure that perpetual access by loading the data on local servers controlled by OhioLINK. Only one publisher

has been included in the OhioLINK EJC for which we do not have perpetual rights, American Chemical Society. However, the investment required in the archiving process is considerable and the question of who best should perform that function—the library, the publisher, some middleman—is yet to be resolved for most libraries [12].

1.4. How to anchor the existence and easy availability in the minds of researchers, teachers and students

Usage of e-journals may be a generational issue; younger scientists seem to work on screen more readily. Vincent H. Resh writes "A consequence of letting our children play all those video games is that now as graduate students they prefer viewing articles directly on the screen . . . over using paper journals" [13]. Librarians seem to know most about what researchers, teachers and students want as *users.* Publishers seem to know the most about these same people as *authors.* The scientist as author does not have the same viewpoint as the scientist as user and habits vary considerably from discipline to discipline. For example, researchers in social sciences and humanities do not view journals as central to primary communication. On the other hand, engineers value refereed conference proceedings. However, scientists do publish in print journals to establish their claim at a specific time to a specific result. They publish to gain other forms of recognition such as promotion and tenure that require publication. They publish to have their ideas certified independently and to be archived in perpetuity. Finally they publish to communicate with those in related fields who may be interested in their ideas as well as with students working their way into the inner circle of the discipline [14]. However, scientists still fear that e-journals will not make their work available for posterity. Librarians worry about archiving but so do authors. The biggest problem is cost, a problem which gets worse with the more we attempt to save [15].

What other things do scientists want e-journals to accomplish?

- improve the time from manuscript acceptance to publication by making the papers available electronically before the print version is available;
- move access to the desktop so that the researcher does not have to come to the library. For example, the author did the vast majority of the research for this paper 100 miles from the OSU Libraries in the comfort of her home office using the EJC and other online tools.
- incorporate multimedia in journal articles —again many of the charts and tables used in this publication were developed by OhioLINK and could be sent to the author electronically for inclusion in this paper.
- include hypertext links from references to abstracts and full-text where available.

Hunter also draws an interesting distinction between the needs of users (students, graduate students and faculty) and libraries. In the past, publishers primarily focused on faculty because they were the authors. Now they are more aware of graduate students as the prime users of the general scientific literature on campus. However, "the surprising result of user studies in the TULIP project [was] that the early adopters of the system were undergraduate students instead of the postgraduate population generally looked upon as the core readership of Elsevier journal titles" [16]. Elsevier also realized that faculty spend very few dollars on purchasing information themselves –maybe a personal subscription or two. Instead, the assumption is that the library has always provided this information for them before and they will continue to provide the new

services. So, the publisher must focus on pleasing both the user and the buyer. One approach by Elsevier is "offering services which are much more focused on specific user communities. We could offer clusters of services, for example, in neuroscience, and include not just our long list of journals, but also brain maps and links to genetics databases. When we talk with the specialist scientists about these ideas, they love it –there is no question about it. But is the library going to buy this sort of connected community for the neuroscience faculty?" [17].

Another measure of the usefulness and adoption of a new system is the number of repeat users. Borghuis proposes the need to analyze the number of first-time users and one-time users indicating the number of end users who have at least tried the system. "The next step then is to identify those users who show repetitive use within a certain time frame. Only when the number of repeat users is increasing can conclusions about the level of success of the service offered be drawn. When a user does not return after initial trial, it is valid to evaluate either the existing infrastructure or the eagerness of the end users . . . or both. High-quality communication and training form an important precondition for getting end users to use the service at all. Analysis of one-time and repeat users could be followed by qualitative research (focus groups or interviewing/questionnaires) to get a better understanding about why one-time users only tried the system once or, in the case of a large number of repeat users, what they do like most" [18].

Borghuis goes on to espouse the OhioLINK philosophy of end-user choice driving access. "When full-text electronic journal information becomes available on a wide scale, the influence of the real end users on what is relevant will increase to a considerable extent. This could lead to a 'power shift' in the information chain toward the 'evaluating' end user. It is then not so difficult to imagine that besides citation analysis (which focuses on author behavior), usage analysis (focusing on end-user behavior) will provide an influential second source of information to evaluate the quality of published information and of library collections. It might be expected that usage analysis will increase in the coming 3 to 5 years, when a growing number of end users prefer to use 'electronic' information in addition to visiting the library to examine the 'paper' collection. Logfile analysis is an important instrument to make the behavior of these end users transparent" [19]. Most of the data collected by OhioLINK to date is logfile analysis. Little has been done yet in the area of interviews or questionnaires.

1.5. Usage

Measuring the use of print journals has always been if not impossible certainly so staff intensive as to be impractical. Providing journals in electronic format offers the opportunity to study usage in a more systematic way. The data can be used to gauge low and high use titles to inform budgetary and selection decisions. Most of the usage studies of electronic journals have occurred in the latter 1990s once a concentration of e-journals has been made available to users. In the author's research for this paper, she was struck by the conflicting results and conclusions drawn from the data gathered. For example, the following is a listing of some findings from various usage projects such as the European Union Project DECO-MATE, University of Michigan's PEAK Project, as well as others

1.6. European union project DECOMATE

- Users considered the service to be useful but not essential although it did save them the time of going to the library to retrieve material.

- Users wanted personal profiles, an alerting service, links to other services, and titles listed by subject heading.
- Inhibiting factors included the number of titles on the system, the short time span covered, possible information overload, and legibility of articles on-screen.
- Encouraging factors were desktop access, twenty-four hour availability, ability to print, democratized literature searching by enabling equal access for all scholars, and ability to navigate around an article.
- The system would need to grow to cover ten years worth of material in order to be useful for teaching as opposed to research [20,21].
- "The number of very heavily used journals will be small; the number of frequently consulted articles will likewise be small;
- The article, not the journal, will become the 'unit of information;'
- More flexible and cost-effective management of journal collections will be possible;
- E-journals will be used as current awareness tools until there is a sufficient critical mass;
- Libraries operating from the access end of the access-ownership spectrum may find it simpler to build collection profiles to match user needs" [22].

1.7. University of Michigan's PEAK project

- Most articles are used only once.
- Eighty per cent (80%) of accesses occurred in 37% of the available titles (close to the 80/20 rule); most articles are used only once.
- In cases where tokens were used for the purchase of individual articles, one of the participants, Vanderbilt University found after three months in the project that they had only used 281 of the 5,400 tokens they had purchased. They did two additional things: added the URLs to the catalog records for titles they owned in print (but not the other titles available) and they added the titles to the e-journal list on their Web site. As a result, usage doubled. In addition, they expanded the project to undergraduates at this point (and still only used 2,800 tokens the first year).
- Engineering was the subject area most heavily used; in addition, the library print collection in this area was weak
- 637 journals were accessed —289 (45%) were titles owned in print; 348 (55%) were titles not owned in print
- 15 titles in the top 30 used titles were not owned in print (all were in Engineering)
- Delays in getting titles into the online service impacted usage for some titles such as *Tetrahedron Letters*
- Each article purchased by token was used on average 2.7 times (after the article was used it became part of free access that you could get to without the password which may have been a factor in driving this usage figure up) [23].

1.8. Generalized findings from several studies

- Users don't want to have to deal with multiple interfaces
- Users don't care who the publisher is

- Users look for articles not journals [24]
- ". . . browsing of the issue still has significant value. The concept of the journals is still valid as more than a random collection of articles" [25]
- ". . . a good local reference database is a very popular service and is of vital importance. . . . Some researchers, however, are focused on the 4 or 5 journals they are most interested in, and just want to have direct access to the most recent issues, bypassing the reference database" [26].

Referring to Vanderbilt's participation in the PEAK Project, John Haar, AUL for Collection Development, indicated that the usage data received in and of itself was worth the $43,000 investment his library made. He concludes that the availability of a comprehensive set of e-journals from a publisher frees the library from trying to guess what users want and letting them decide for themselves [27].

The JSTOR Project (a non-profit organization which digitizes the complete backfiles of core scholarly journals) recently completed a preliminary evaluation study of their product over the first three years of usage. Kevin Guthrie, President of JSTOR, presented these conclusions from the preliminary study:

- "The availability of older journal articles in electronic form through JSTOR seems to have increased the use of the older articles in participating sites. We compared recent JSTOR usage in a three-month time period with some benchmark data we collected from usage of the same titles at 6 colleges and universities in JSTOR's early days. Usage of the same titles not only was much higher, but has been growing at a dramatic rate.
- Researchers and students value the interdisciplinary nature of JSTOR. During one week of JSTOR usage, 90% of searches were conducted over more than one title, and 69% covered more than one cluster.
- Older literature remains valuable in many fields. As a first measurement of the value of the article in JSTOR, we analyzed the top ten most frequently viewed and printed articles for each title in the JSTOR database. What we found is that there are more older articles among the top ten then we originally expected. . . .
- Citation data alone do not reliably predict electronic usage. Judging by the most-used articles in JSTOR, citations and usage are not closely correlated, suggesting that citations should not be used as the sole factor in selecting content to be digitized. To give just one example, the most frequently viewed article from one of the top journals in the economics collection has rarely been cited in other articles. The article, published in 1973, was cited only fourteen times between 1974 and 1999. Nevertheless, this article has been viewed 1,895 times and printed 1,402 time since it was made available in JSTOR, making it the 4th most-used article in economics" [28,29].

These conflicting findings–for example, the journal no longer matters; researchers still value the concept of the journal–are initial at best. They clearly show that data are now available that has never been available before. But, the results are still very shallow reflecting the initial stages of implementation of electronic aggregations. As more data becomes available, more sustained and reliable patterns are likely to emerge.

1.9. Usage of OhioLINK EJC

With those general and somewhat conflicting findings in mind an analysis of the usage data from the OhioLINK EJC is appropriate. The initial database of Academic Press and Elsevier titles was introduced in April 1998.

Table 1
Average article downloads per week

Time Period	**Average No. of Article Downloads Per Week**
First Week	1,807
First 22 weeks	2,200
Fall Term 1998	8,000 to 9,000
Winter Term 1999	9,000 to 12,000
Fall Term 1999	22,000
Winter Term 2000	26,000

The initial file included data from 1995 and 1996 backfiles as well as current 1997 issues. Tables 1 and 2 illustrate the average per week and annual article downloads since the inception of the EJC [30,31].

When looking at the specific journal titles in April 2000, 2,500 journal titles were available in the EJC; virtually all had had articles downloaded from them. Only 1,750 of these titles were previously held by in any Ohio college or university library [32]. In June 2000, there were 2,906 ISSNs loaded (equivalent of titles). Of those 2,906 titles, 2,831 of the titles were accessed between January and June 2000 [33].

In looking at OSU in particular, "From July 1998 through June 1999, Ohio State personnel downloaded more than 92,000 articles from [the EJC] . . . ; approximately one fourth of the usage has been from titles to which we did not previously have access. The next heaviest user was the University of Cincinnati, with approximately 40,000 articles downloaded. There has been very heavy usage [in the early stages] despite the fact that the service has not been advertised, the titles are almost exclusively in the areas of science and technology, and there have been some technological problems" [34].

Full analysis of OhioLINK EJC usage occurred in March 2000 covering the time period April 6, 1998 through March 31, 2000. The primary focus of the analysis done by OhioLINK was how much of the use (measured as downloaded articles) was from materials that the libraries did or did not hold in print at the time the license was signed. This data were produced to begin answering the question: Do these licenses expand access to information, and if so, how much? Only 184 of the 2,500+ titles had more than 500 article downloads. Only 104 titles had fewer than 10 articles downloads. Forty percent (40%) of the titles delivered 80% of the article downloads. Forty-five percent (45%) of the titles deliver 10% of the article downloads. Over 77% of the **titles** used were not held on campus; 51% of the **articles** used were not held on campus [35]. Sanville includes a number of charts illustrating these findings in his article which "summarizes the dramatic expansion in journals used in our major universities when compared to the titles that were previously owned in print.

Table 2
Annual article downloads

Year	Annual Article Downloads
April 1998-March 1999	280,000
April 1999-March 2000	740,000
April 2000-March 2001	870,000 (estimated as of June 2000)

On average, each Ohio university owns in print 588 titles published by all EJC publishers combined. In the twelve months from April 1999-March 2000, patrons downloaded articles from an average 2,079 titles per university, a more than tripling in titles used over print access. The range of this phenomenon was widespread, from a low at Youngstown State of 1,199 titles used to a high at Ohio State of 2,501. Some would argue that surely Ohio State, with 1,253 of the EJC titles in print, must already be meeting most of their campus' needs. In fact, the EJC doubled the title access at Ohio State" [36].

One way to clearly quantity the usefulness of this data are to analyze what it would have cost in traditional print subscriptions or document delivery to achieve this same volume of access. In the 1999 analysis which focused exclusively on Elsevier and Academic Press titles, "120,000 articles were downloaded from titles not held in print at the requesting patron's campus. Of those, 86,910 were over the fair use 'rule of 5.' At what substantial costs could these have been delivered as timely? If you assumed libraries bought new print subscriptions for titles that had more than 5 downloads, 4,176 print subscriptions would need to be added. At an average cost of $1,500 [easily the average cost of Elsevier and Academic Press titles], this would be over $6.2 million per year. If we assume the 120,000 articles were delivered via document delivery, that could easily be over $1,000,000. As we continue to examine the use made of the EJC and our costs, I [Tom Sanville] believe we will easily conclude the cost-benefit relationship will be very good" [37].

The Ohio State University specific data are equally interesting. At the beginning of the license, OSU held 782 titles in print (656 from Elsevier, 126 from Academic). As the largest library in OhioLINK our print holdings at 59% were the most extensive. The next closest library was the University of Cincinnati at 46%. The average percentage holdings among the 15 research institutions in OhioLINK was only 27%. During the first year, Ohio State users downloaded articles from 1,270 titles held in the EJC; 761 of those were also held in print, 509 titles were not previously held in print. During this time period, OSU patrons downloaded 74,512 individual articles from the EJC; 53,972 were from titles previously held in print, 20,540 were from titles not held in print. Of those 20,540 downloaded articles from titles not held in print, 18,262 would have been over the fair use rule of 5. From a percentage perspective, 40% of the **titles** downloaded were not held in print, 28% of the **articles** were from titles not held in print. As you can imagine, for libraries which held much fewer titles in print at the outset, their percentage of downloaded articles was even higher. All of the other 14 research institutions saw percentages of titles downloaded which were not held in print of over 50% and in most case in the 70–80% range.

While the analysis above focuses on the largest 15 libraries, the data are also available for all 48 OhioLINK institutions which participate in the EJC. While we think of Elsevier and Academic Press titles as very scholarly and of most use to research institutions, the small colleges and 2 year institutions do make use of this access as well. For example, Southern State Community College was chartered in 1975 by the Ohio Board of Regents. The college provides a variety of programs leading to the associate degree in arts, applied science, science and technical studies.

SSCC experienced considerable growth in the past few years and now enrolls over 1,600 students.

Table 3
Average use of small colleges

Category	Average	Low	High
Journals Owned in print	15	3	54
Journals titles downloaded	410	45	1,028
Journal articles downloaded	2,057	126	6,284

Even a campus this small and with very focused programs has made significant use of the EJC. SSCC subscribed to no Academic or Elsevier titles in print so 100% of the titles downloaded were accessible to them only through the EJC. Between April 1998 and September 2000, SSCC users downloaded 3,254 articles from over 600 titles. The most heavily used titles were *Journal of Vocational Rehabilitation* (107 downloads); *Journal of Adolescent Health* (93 downloads), *European Neuropsychopharma-cology* (53 downloads), and *Child Abuse and Neglect* (52 downloads). Tables 3 and 4 shows usage for the OhioLINK small colleges and 2 year schools.

As with SSCC, very few of these titles were held in print but the institutions are making more usage than they could have from their print holdings.

As a result of this first year's data, the following conclusions can be drawn:

- What we have in print is not what we need
- The expansion in use can be dramatic
- Expansion/integration of the EJC will breed more use
- We have the means to change the economic dynamic to allow evolving expansion over rationing and forced selection
- There is strength in diversity and group action.

1.10. Organizational impact of having these journals available

Ohio State has remained committed to its online catalog as the source of pointers to electronic content through traditional cataloging. As a result, all EJC titles as well as titles acquired in electronic format at Ohio State (apart from OhioLINK initiatives) have a record in the online catalog. The biggest organizational impact of e-journals is how to represent them in the catalog alongside their print counterparts. There is considerable discussion and difference of opinion nationally and internationally between catalogers and with public services librarians about whether the electronic copy of a print journal should be cataloged or noted in the record for the print version or whether two separate records are needed.

Table 4
Average use of two year colleges

Category	Average	Low	High
Journals owned in print	only 5 of 17 institutions had any subscriptions	1	4
Journal titles downloaded	86	22	197
Journal articles downloaded	244	36	713

At Ohio State at this point in time, separate records are created for titles in electronic form. So, if the user searches a title such as the journal, *Journal of Academic Librarianship,* their search retrieves two records (one for print and one for online) from the Web version of the OhioLINK catalog. On the record for the print copy of the journal there is no URL to indicate that online holdings are available but the user can determine what is held in print. On the print record the user can see a summary statement of the print holdings followed by individual records for each physical piece on the shelf and its circulation status

In the online record, the user sees a clickable link which says "connect to web site" which takes the user to the table of contents for the full-text available. If the user clicks on the table of contents for a particular issue, they get a listing of the titles, authors and number of pages. Clicking on the specific article wanted results in the display of the full text in PDF form. From the table of contents in the EJC the user can also link to the publisher's information page for the journal title. However, if the piece wanted is not in the EJC because of its age, the user is given the option to check the catalog for other issues.

In a consortial catalog, one problem that comes into play occurs when an individual library has licensed an electronic product for its users which does not apply to other libraries in OhioLINK. For example, if the user searches for *Journal of Managerial Psychology* in the OhioLINK central catalog, they will find a record for the online version. The clickable link is displayed. However, once the user clicks on that URL they are taken to a screen which requires a password and user id for access which most users will not have. If the user goes back to the catalog record and clicks on the line which indicates that one OhioLINK library owns this title, the can see that the title is "held" by the University of Cincinnati. However, there is nothing in the current display to tell the user that they cannot have access to this title unless they are a registered patron of the University of Cincinnati Library. In fact, the display looks like any other leading the user to expect to access the title. OhioLINK committees are currently working on uniform wording for the displays for these types of records. The option to suppress these records from the central database also exists but suppression would also deny access to legitimate users would might also come across the title there. The proposed wording reads: "Access to this electronic resource may not be available at all locations. Check your local online catalog for availability."

Another problem is how to link the user from a citation in a database to the full text of the title which may be available in various formats, only one of which is paper. Users see links for electronic versions to which they do not have access (such as locally licensed resources which have a URL in the OhioLINK central catalog), but do not easily see pointers to the paper copy down the hall. From a technical services viewpoint, the biggest unresolved issue is whether and how to include all formats of a title on a single bibliographic record. Public services argues effectively for a display which may read as follows:

v. 1–3 in print on the shelf at DT674.c56 in the Main Library
v. 1–10 in microform on the shelf at DT674.c56 in the Microforms Reading Room
v. 8- to the present available electronically via the URL http://lib.ohiolink.edu/Test/

This sounds simple in theory but there are many difficulties in actual practice.

1.11. Shift in type of work done

Karen Hunter comments in a 1997 article that "the sale of electronic journals needs more

explanation, technical support and sales support. And the caliber of person you need to hire to do this is higher and more expensive than in the paper journal environment." [38] This holds true as well for libraries trying to deal with the acquisition, licensing and cataloging of e-journals. One of the goals of the 1999 reorganization of technical services at Ohio State was to redirect resources from former tasks to new tasks related to electronic resources. In addition, individuals who have the ability to handle complex, ever-changing routines were selected for those positions. Not only is the workload greater, it is also more complex. E-journals do not fit nicely into the existing routines and models which exist for print products –instead new approaches must be identified and staff and librarians are learning to live with more ambiguity in the management process. One solution works for one product but not another. For example, the license for Elsevier titles was initially based on the individual subscription cost of the print version of the journals. However, as the contract has progressed the ability to track the cost on a title by title basis has been lost. The money currently being spent covers the print copies that were held in the past, electronic access to the titles currently held in print, as well as the electronic access to titles never held in print. How do we divide that lump sum among these three categories of titles? The only reason it matters to the Libraries is that the need still exists to attribute costs to individual disciplines to indicate how library money is used to support each academic program. That information is no longer readily available without engaging in additional, time-intensive routines for tracking costs

Libraries also have data management problems with e-journals which are the same sorts of problems that libraries have with print subscriptions but currently no tools exist to help resolving them. For example, when an issue of a print journal does not arrive, the library claims the missing piece through their vendor. This claiming is prompted by automated features in the library serials system that predict when the next piece should arrive based on the pattern of receipts in the past. When an issue of an electronic journal fails to arrive, there is no vendor to contact or claim. In addition, there is no check-in of the electronic issues so the computer system does not alert the library that an item is missing as the system for print titles would. Instead, libraries must rely on users and staff to find problems and notify someone of that problem. Fortunately, the EJC software can detect missing issues but most local integrated library systems cannot. Specifically, these data management problems include: missing titles, missing issues, title changes, PDFs that do not open, PDFs that are blank, PDFs with incorrect character sets, and no article analytics or link to the journal [39].

Although the EJC can detect missing issues, it is only as effective as the data it receives from the publisher. For example, the OhioLINK EJC generates duplicate title entries if the ISSN supplied by the publisher is incorrect. For example, as each article is loaded it includes the ISSN of the title with which it is associated. If that ISSN matches an existing listing in the journal title index, the article is simply added under that structure. If the ISSN is incorrect and does not find a match, the load of the article creates a new (or duplicate) listing for the journal title in the journal title index.

This same sort of maintenance problem occurs when linking article citations to the catalog records for the journal in question. For example, OhioLINK's Periodicals Abstracts provides links to the catalog record for the journal title so the user can see the availability of the print holdings for a particular journal across OhioLINK. If the OCLC record used to catalog the piece is different from one library to another or the ISSN is different, only partial holdings will be displayed giving the patron incomplete information for actually locating the physical piece. When discovered, these problems are reported by e-mail to OhioLINK libraries affected but each library has to make a correction to its record (potentially 78 corrections) to make the link correct and accurate.

Another maintenance problem is simply the usual cataloging maintenance that occurs with

serial publications. For example, despite their electronic nature, these journals still cease, change titles, and in some cases split to add new titles. In 1998, Elsevier purchased Jai Press bringing new titles into the EJC. OhioLINK's solution to this problem is to have these titles monitored and cataloged by OCLC's TechPro operation. We have an OCLC authorization code which is for the entire OhioLINK consortium. Those records are then added to the central catalog and reflect OhioLINK ownership and availability of the title rather than falsely indicating that individual libraries own these titles. The individual libraries also add these records to their local catalogs bearing the OhioLINK central location.

Finally, Ohio State has been looking for a way to include URLs in catalog records for titles which are included in a commercial aggregator such as, *ABI Inform,* which is not structured like the EJC. In *ABI Inform* there are only full-text articles from various journals and no actual presence for the journal such as a page with tables of contents. So if a URL is included in the catalog record, where does it take the user? To the first article from the journal? To a page with a list of all the titles included in the database? OSU has considered pointing the URL to a page which explains what the database is and how to get access to the information included. It is hard to know what would be most useful to the patron but there is no question that the current lack of entries for these titles in the online catalog means that users are generally unaware of the full-text titles included with this aggregator-type database.

1.12. Integration of EJC with A&I services

One of the publisher's key roles with any journal is to support the reputation and brand identity of that journal. "In electronic publishing the opportunities for the publisher to add value to the author's work grow dramatically. Electronic publishing allows the publisher to enhance the article by creating links to related material and, indeed, by offering access on the desktop to the article alone and in a variety of 'packages.' The publisher also adds value by creating sophisticated access and retrieval tools to help readers find the article.

In the paper-only world, each journal from each publisher essentially stood on its own. Others did the linking between and among journals. Abstracting and indexing services created the subject links or access points. Institute for Scientific Information built the backward and forward citation links. Libraries (through their collection development policies, catalogues, and reference assistance) built an environment that physically brought together diverse types of information.

Then, along came the World Wide Web. Linking changed from something a third party does with your journals' articles to a value we publishers add. The publisher is now the 'intelligent agent' responsible for creating links.

There are many ways to link journals electronically:

- from bibliographic searches to the article's full text
- from tables of contents services to the full text
- from a cited reference to the abstract or the full text of the cited article
- from the article to later citations of the article
- via a database of journals aggregated for searching
- from the journals of one publisher to those of competitors . . . .

One continues to hear the argument that electronic publication should be less expensive than paper publication, as if the only costs one had were the costs of physical production. On the contrary, "intelligent agent" electronic publishing is expensive. The process requires the

intervention of thinking people. And, of course, we want to do it all at as low a cost as possible.

In order to create links, we have to invest in people to add the value, whether editorial, production, or information-technology staff. At the same time, we also look for – or create – standards to aid in linking, as that will help keep costs lower. . . . The ultimate challenge is to create intelligent, meaningful links that will enhance value for the scientist and student – creating the richest environment for the articles in our journals" [40].

In February 1999, an invitational workshop was sponsored by NISO to discuss reference linkage, specifically linking from citations to electronic journal literature. The scope statement of the workshop is an excellent summary of the fundamental issue at this stage:

> "End users in search of information want to go directly from a citation in electronic form to the cited journal or journal article in electronic form. The citation may appear in any number of places, including an online catalog, an online index, or among the references in an online text. In the simplest case, the user may achieve a link by clicking on the citation and connecting to a document located on a web page identified by a URL. Increasingly, however, the simplest case does not apply. The identifier embedded in the citation may be old and out of date. The cited object may be behind a firewall or available only through an online service which uses purely internal identifiers. The identifier may be an indirect reference, such as a Digital Object Identifier (DOI), which requires access to a resolver service. To further add to the complexity, a number of copies and/or versions of the cited object may exist, forcing the user to discover which ones he or she is authorized to use" [41].

New initiatives such as SFX and CrossRef had moved these process froward in recent years. OhioLINK will face a specific problem since most of these publisher-initiated approaches will link to the content hosted on the publishers' servers. Because OhioLINK loads the contents on its own servers resulting in unique URLs for this content, OhioLINK will be working with these initiatives to design a local architecture which can move from a citation in a database to the fulltext version which is legally available to the authorized users of OhioLINK. This problem/issue is often referred to as linking to "the appropriate copy." Citation linking is one of the most critical developments in digital libraries at this time.

From the researcher/user perspective, journal literature is just one source of data. Researchers also use raw data, historical literature and original source material, etc. For example, Peter Boyce from the American Astronomical Society has reported that "users of astronomy information have rated links among data as the most important feature of an information system" [42]. "From the end user point of view, the system should provide:

- seamless and painless interconnectivity. User authorizations for access should be passed on automatically without intervention by the user.....

From the publisher perspective the system should:

- use standardized identifiers
- provide automatic assignment of identifiers
- be able to handle links in the pre-publication phase" [43].

Dale Flecker of Harvard identified four major needs from the library perspective:

- operable in a complex environment
    - ° Libraries have many suppliers for both abstracting and indexing services and for

electronic journals—there are hundreds of sources today and will be thousands tomorrow.
    - ° Solutions must work in an environment where the resources licensed and the services used are constantly changing.
- operable over time
    - ° Library collections are intended for long-term use.
    - ° Links must be designed to work over time frames of 25 or 50 years or more.
- find the right copy
    - ° In many cases there will be multiple copies of the same article available. For example, an Elsevier journal may be available in ScienceDirect, in Michigan's PEAK database, through OhioLINK, etc. Many legitimate reasons for multiple copies exist, including performance (caching), different service models, archival needs, and competition. The system must be able to find the right copy for the user, which, in the end, may have more to do with who the user is than with what the journal is.
- Distinguish content and format
    - ° Delivery formats for a given article will vary with technological change and the environment of the user. Linking should be to a given content, not to a given format.
    - ° The linking system should take the user directly to the content not to the super-structure (like the publisher's search system) in which the content might reside [44].

2. Conclusion

"One thing is clear. Users use what's available. And increasingly *available* means *immediately*. The titles of publishers we are able to move into the [EJC] environment. . . will be the most heavily used and most heavily protected within the budget. Publishers outside this model will be at a much higher risk of cancellations. As a corollary, the publisher with titles accessible through this environment will become more attractive to authors" [45].

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